



Isotope-sensitive CO₂ Analysis and CH₄ Detection by NIR Diode Laser Absorption Spectroscopy (DLAS) for Monitoring at the Ketzin Carbon Dioxide Storage Site

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The capture of CO₂ and its storage in the underground (sequestration), which may be regarded as an attempt to reduce anthropogenic CO₂ emissions into the atmosphere, requires sophisticated techniques to monitor possible leakages at the storage site. As an important European reference CO₂ storage site, the Ketzin saline aquifer near Potsdam, Germany, is under intense investigation. Both, the isotopic analysis of CO₂ and the detection of methane within the former natural gas reservoir provides valuable information concerning gas sources, transportation paths, displacement processes, etc.

A tunable diode laser absorption spectrometer (DLAS), using an external-cavity diode laser in the spectral range around 1.6 μm, a Herriott-type multipass cell and wavelength modulation spectroscopy (lab-DLAS), has been developed to detect simultaneously the overtone bands of several gases. In the selected spectral region there are no interferences with water vapour and no cross-sensitivities towards other gases. In a national priority program, a flexible and compact fiber-coupled DLAS suitable for field campaigns (field-DLAS) has been designed. The new experimental setup with a distributed feedback (DFB) diode laser realizes the high isotopic resolution of CO₂ and other gases, e.g. CO, and the simultaneous detection of methane. Certified gas samples were filled into multipass cells up to a total pressure of 50 mbar. The overall experimental precision of the spectrometer was tested by iterative runs, long-time measurements and calibration plots. As analytical parameters detection limits and isotopic resolutions will be presented. Gas samples withdrawn at the Ketzin site were characterized. The results obtained will be presented within the framework of optical stable isotope detection as valuable tool for geoprocess monitoring.